Asynchronous Point To Point FSK- FM Radio Telemetry System With Data Encryption For Monitoring Environmental Conditions

by

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ABSTRACT

Telemetry systems are an important part of communication and control technologies in today's applications such as in military, medical and environmental sciences. One of its main tasks is to acquire data at a remote location and send the data to a location either through cables or radio waves where the data can be received for analysis. The main objective of this research is to study and develop a ciphered Frequency Shift Keying – Frequency Modulation (FSK-FM) radio telemetry system for monitoring environmental conditions. The system comprises of a remote telemetry station (RTS) as a data collection center and a base telemetry station (BTS) as a data evaluation center. A software programming based on LabVIEW was developed for data processing and presentation. The data collected at RTS site are encrypted prior to transmission to the BTS by employing the One Time Pad (OTP) and Caesar Cipher algorithms. Serial asynchronous transmission was used as data communication protocol via RS232 port. Free Space Propagation, Two Ray Ground Reflection and JTC models were used to predict and compare the received power of the telemetry system. The developed telemetry system is 99.35% accurate compared to Free Space model. The performance of the developed telemetry system is also successfully evaluated in the laboratory and field for 1000m range. The results of the evaluation show that there is no bit error during 300 and 600 bps data rates and the average SNR is 26.07 dB. The accuracy of data integrity is determined to be at 99.9945%.

CHAPTER 1

INTRODUCTION

Radio telemetry is a technology concerned with the transmission of measured physical quantities such as temperature, humidity, and pressure from a remote location to a base station using radio frequency (RF). By definition, telemetry means measurement at a distance [1]. According to Aubin [1], telemetry systems have become an important part of communication and control strategies throughout many industries. Today, telemetry systems are widely utilized for various applications such as for the military, industry, biomedical and environmental sciences. For instance, in military applications, telemetry systems are used in the testing of moving vehicles such as aircrafts and missiles [2]. In commercial industry, wireless telemetry systems are applied for monitoring internal vibrations and strain in rotating machines, chains and vehicles eliminating the usage of slip ring and wires [3]. Meanwhile, in biomedical sciences, telemetry systems are utilized in the monitoring of patients' physical parameters such as blood pressure and heart beat without heavily burdening the patients with wires that will restrict their movements. Wireless telemetry systems are also widely used in studying animals' behavior for a long duration of time. In environmental sciences, the systems are utilized for monitoring ambient temperature, humidity, atmospheric pressure and wind speed for meteorological purposes.